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A1R429X A1R461 A2C A20T14 A20T3
U1S S1405 S1573 S1958

(56) Documents Cited
GB 2214261 A GB 2049868 A GB 1442190 A
US 4287245 A

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INT CL^6 F16L 59/00 59/02

(54) Pipe insulation element

(57) A pipe is surrounded by a number of insulation elements; each insulating element 1 comprises a curved external covering 2, especially a sheet of metal or plastics material, having flanged edges 4, 5 and containing rigid foam 3 provided on its joint surface with a layer of flexible foam 4 with a channel for the pipe and optionally complementary formations 7, 8 for engaging with like element(s). The element may be semi-cylindrical, or third or quarter-cylindrical. Alternatively, the element comprises two semi-cylinders hinged together at the covering 2. Extra elements may lie inside such elements to build up an insulating assembly.

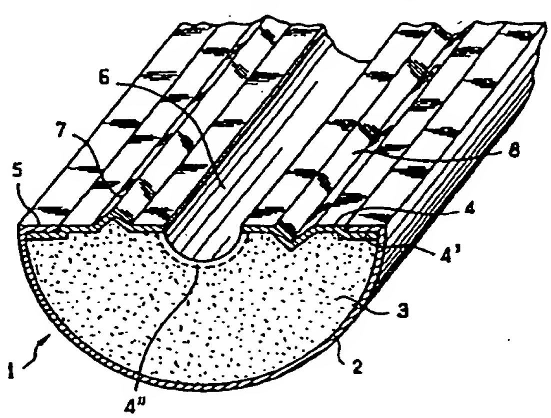

FIG.1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

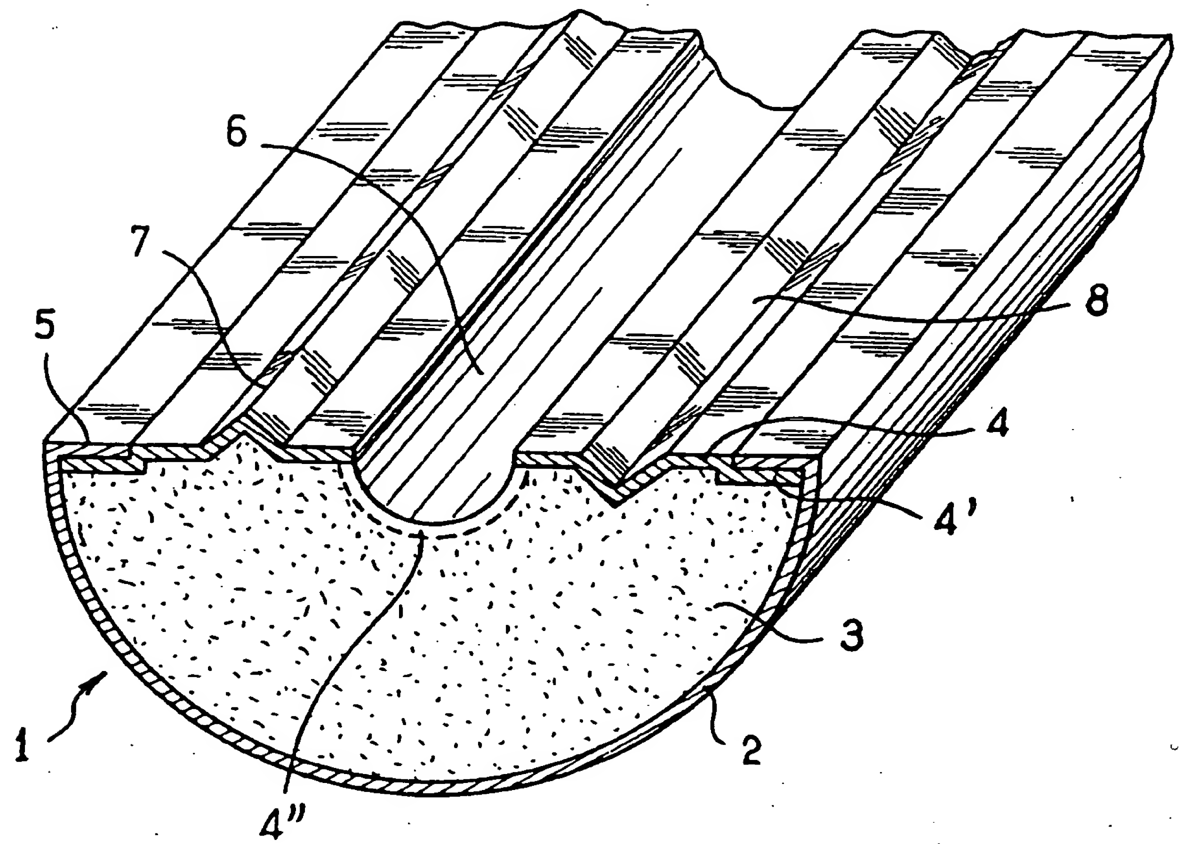


FIG_1

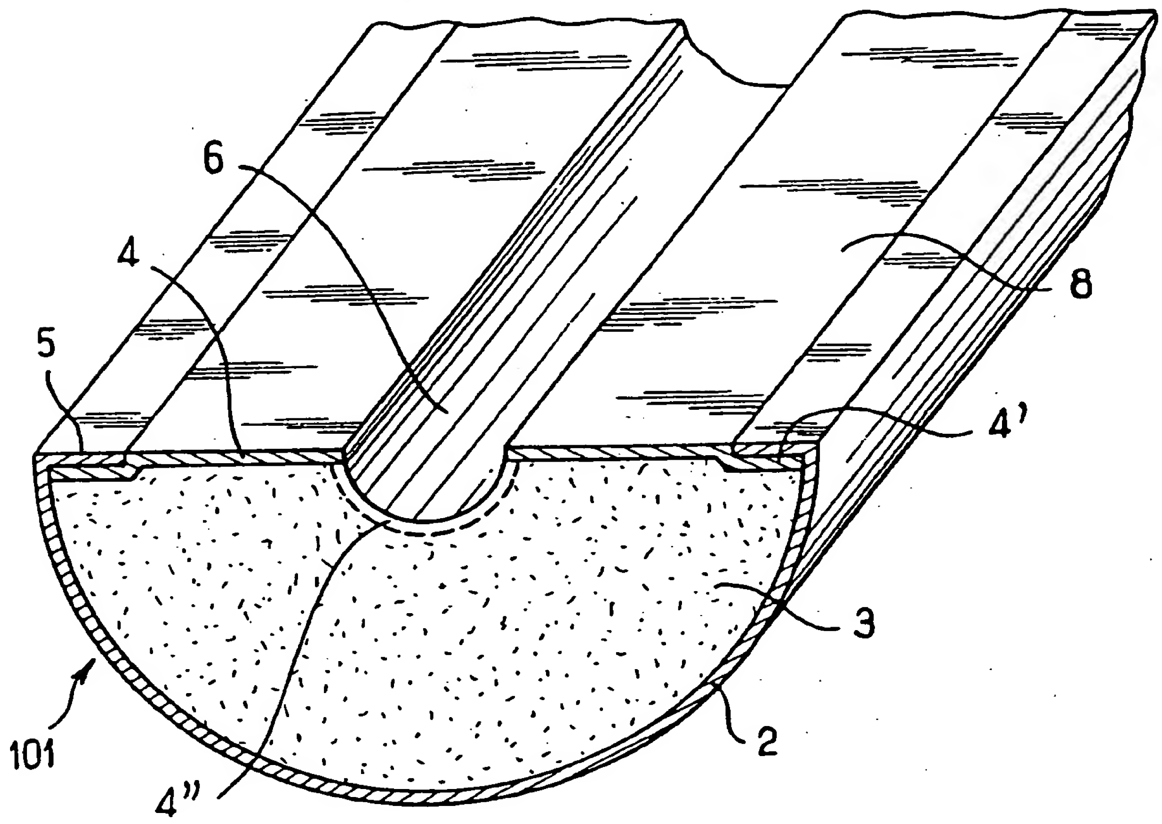
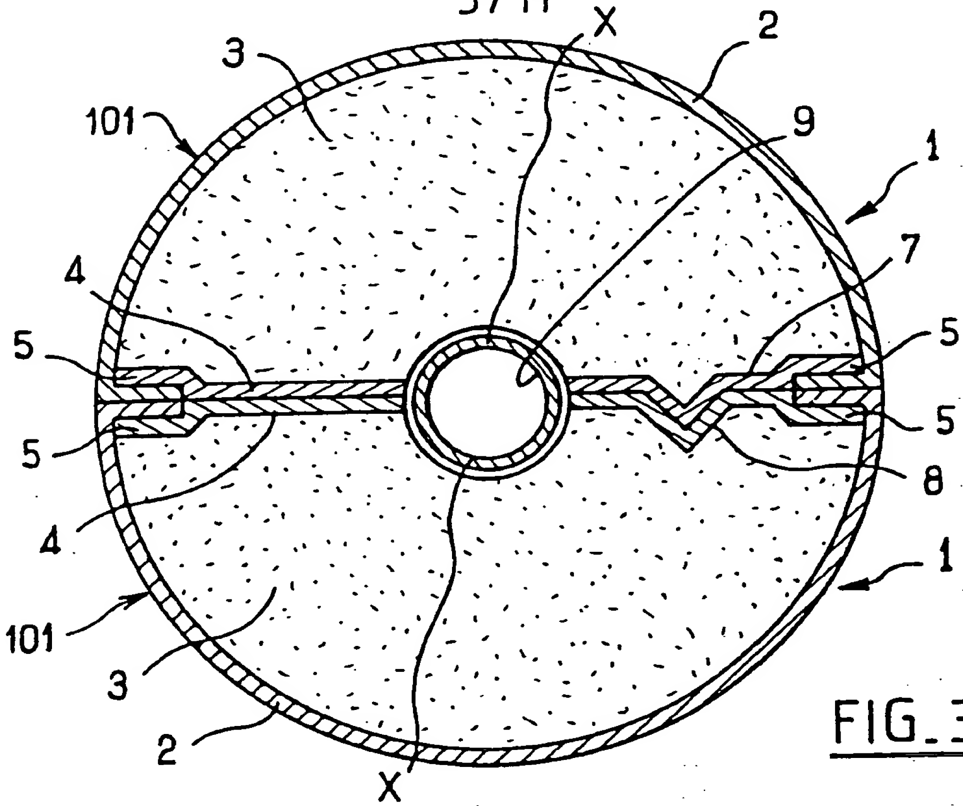


FIG.2


X
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3
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FIG_3

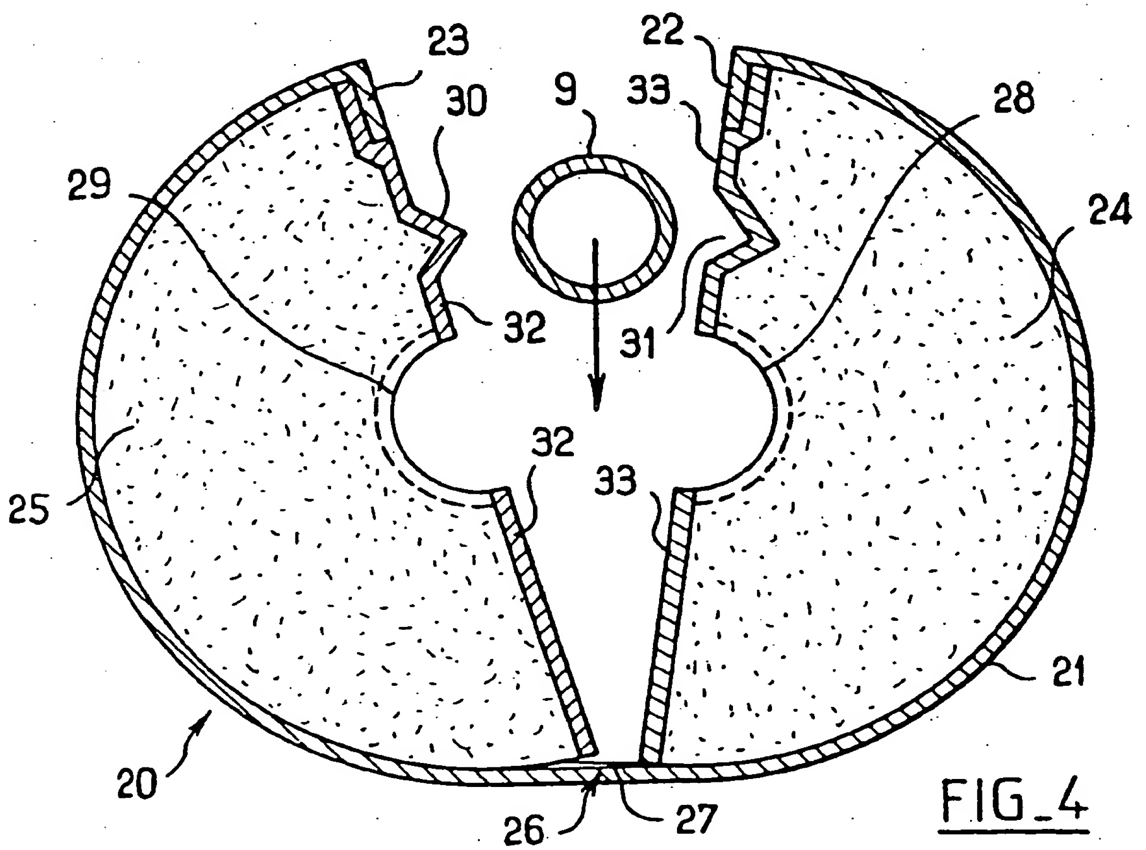
23
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FIG_4

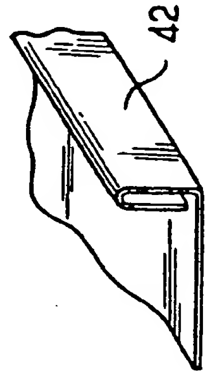


FIG.5B

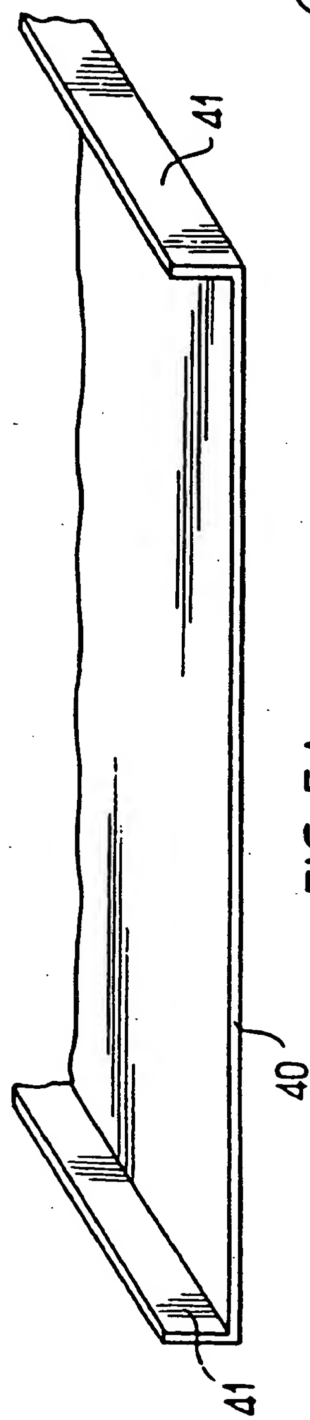


FIG.5A

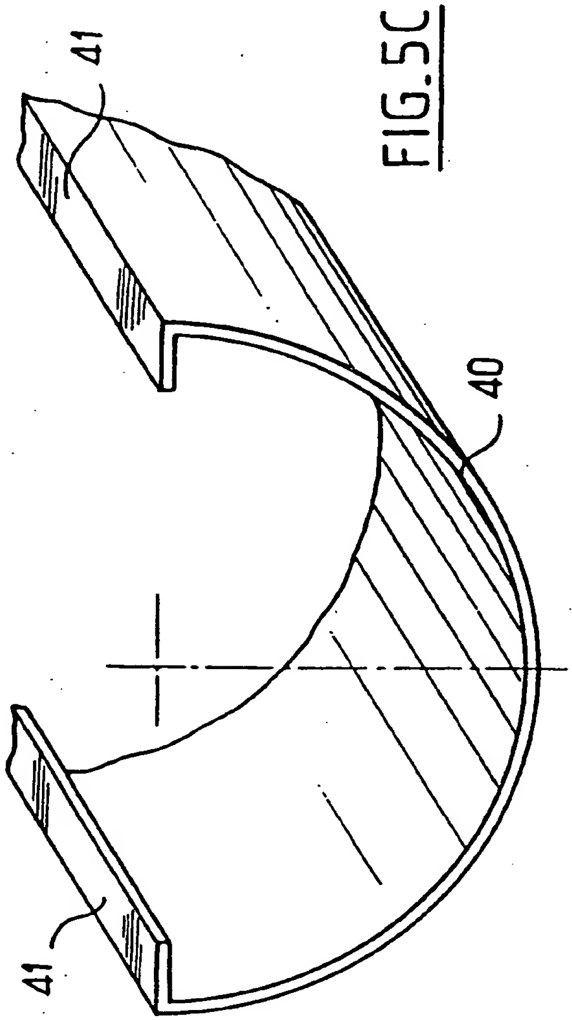


FIG.5C

30 +1 96

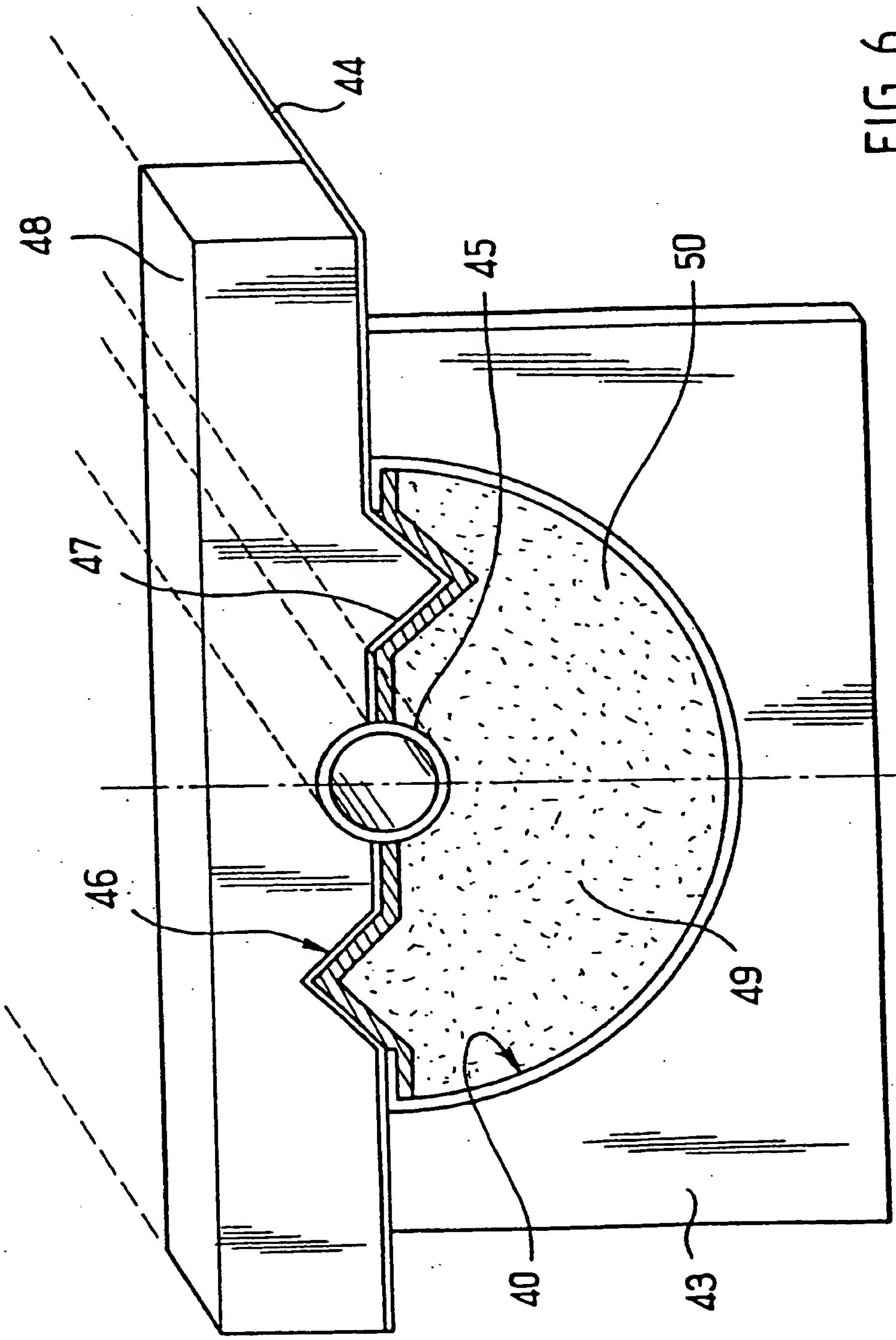


FIG. 6

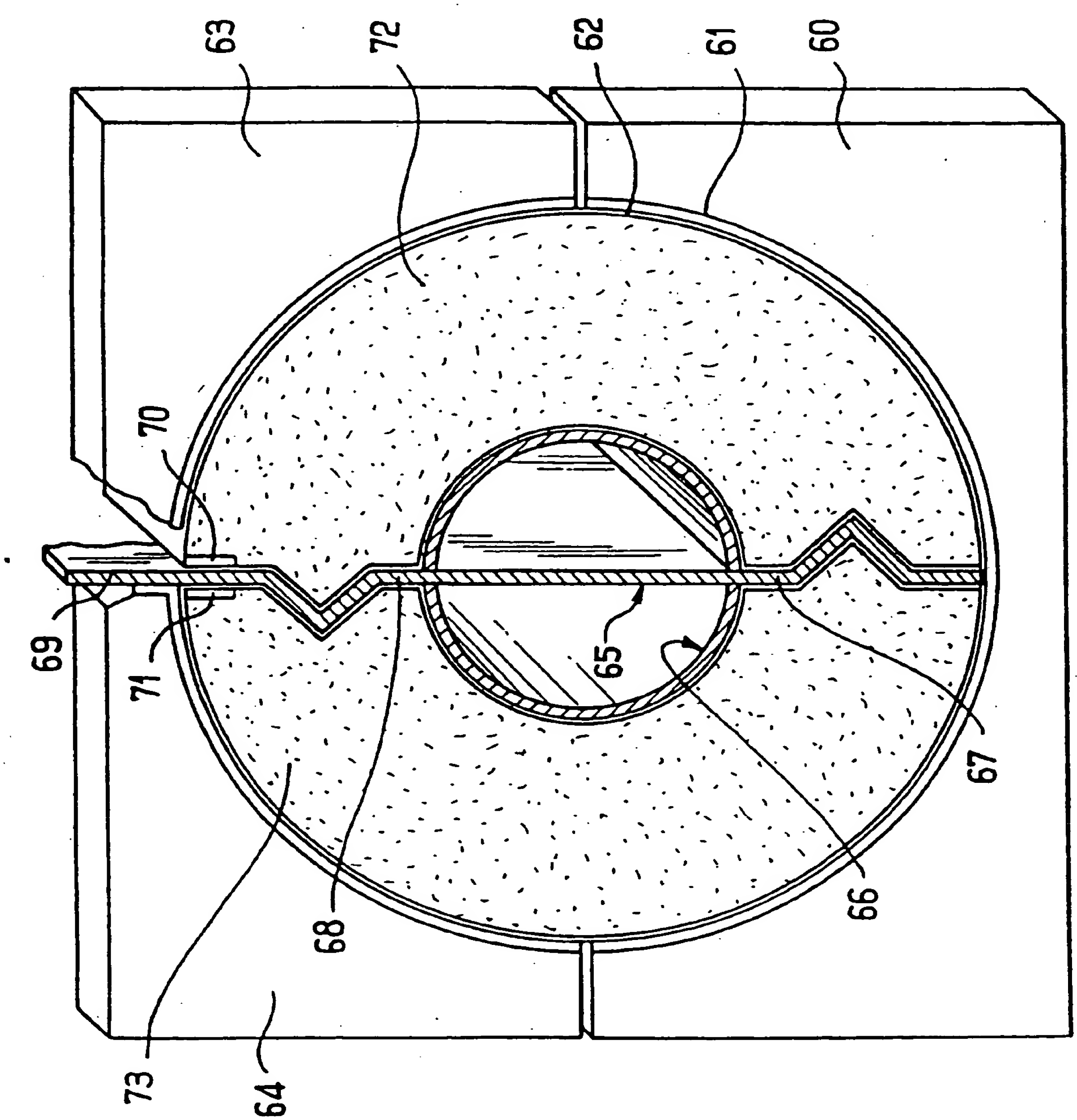
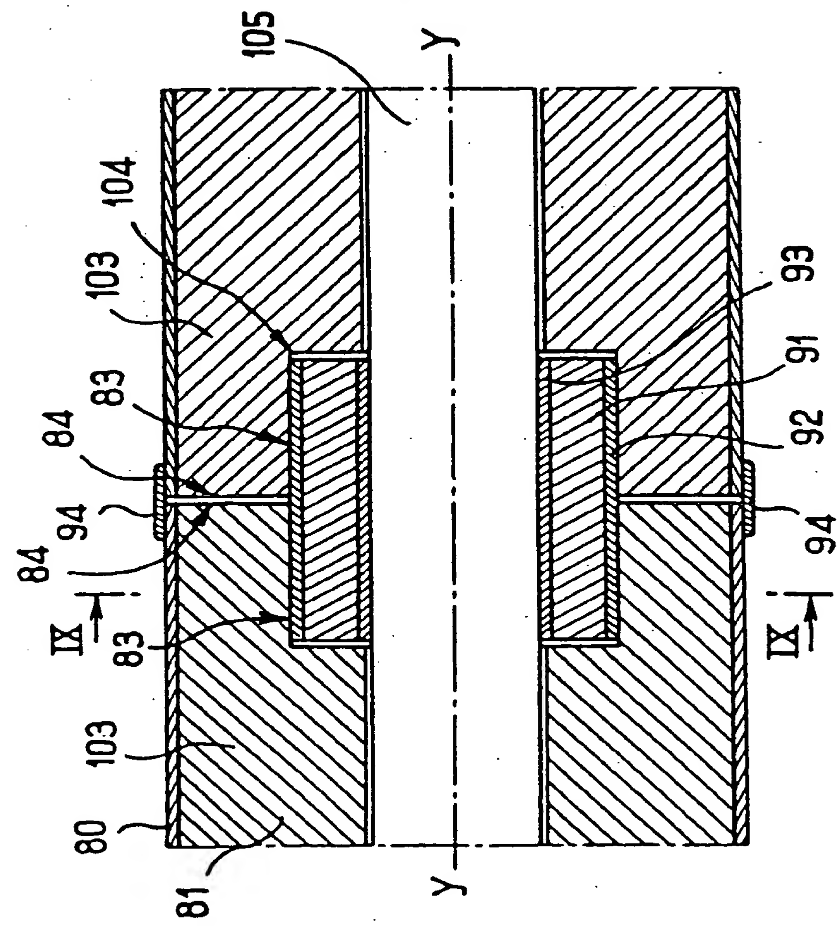


FIG_7



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Y
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103
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81
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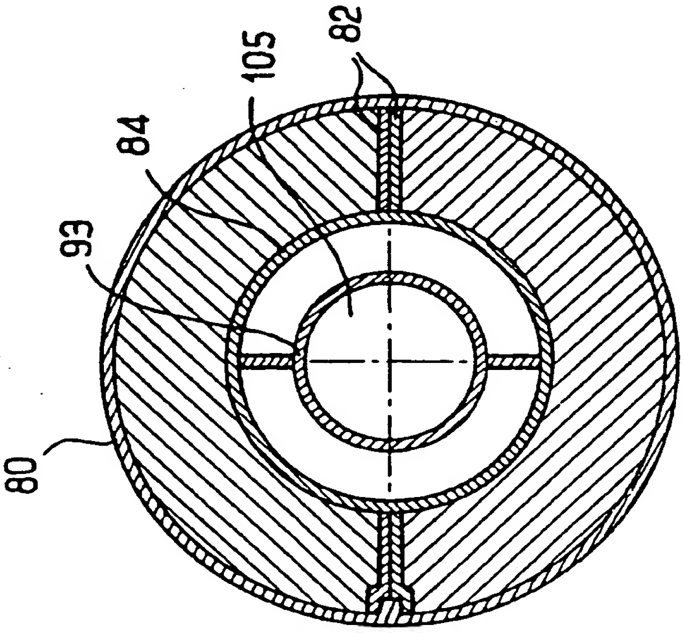
91
92
94
IX

FIG_8



82
105
84
93
80

FIG_9

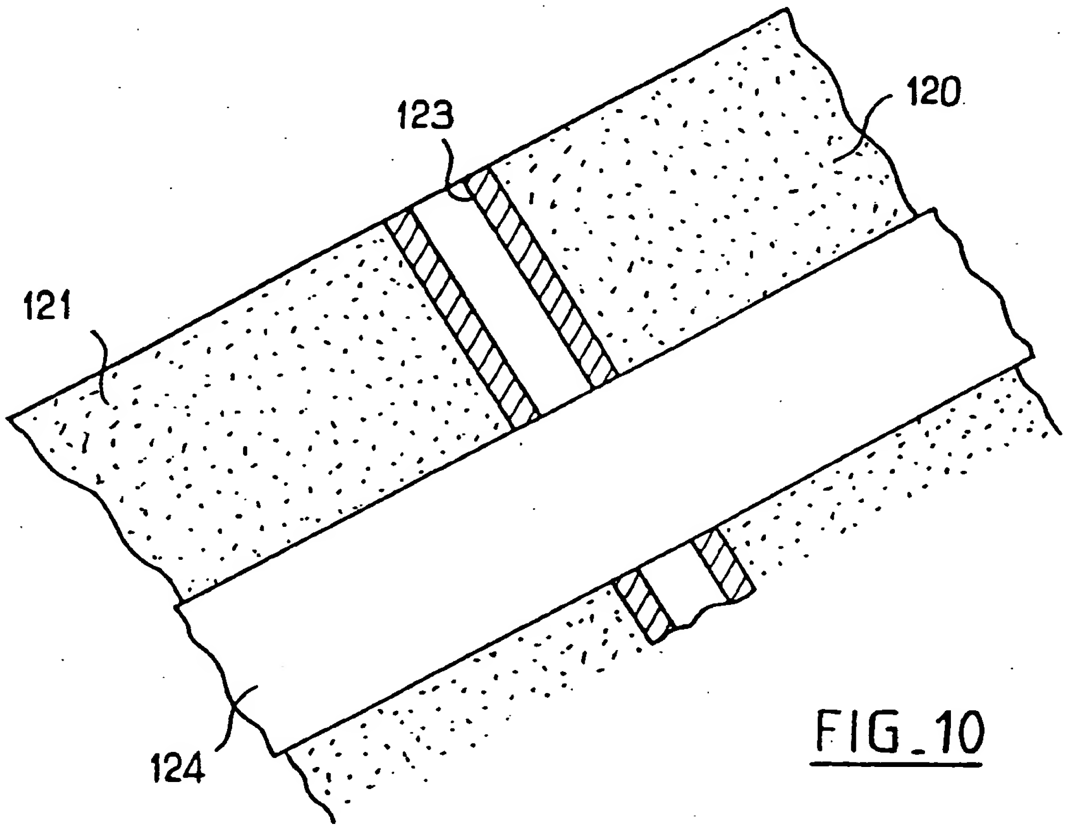


FIG_10

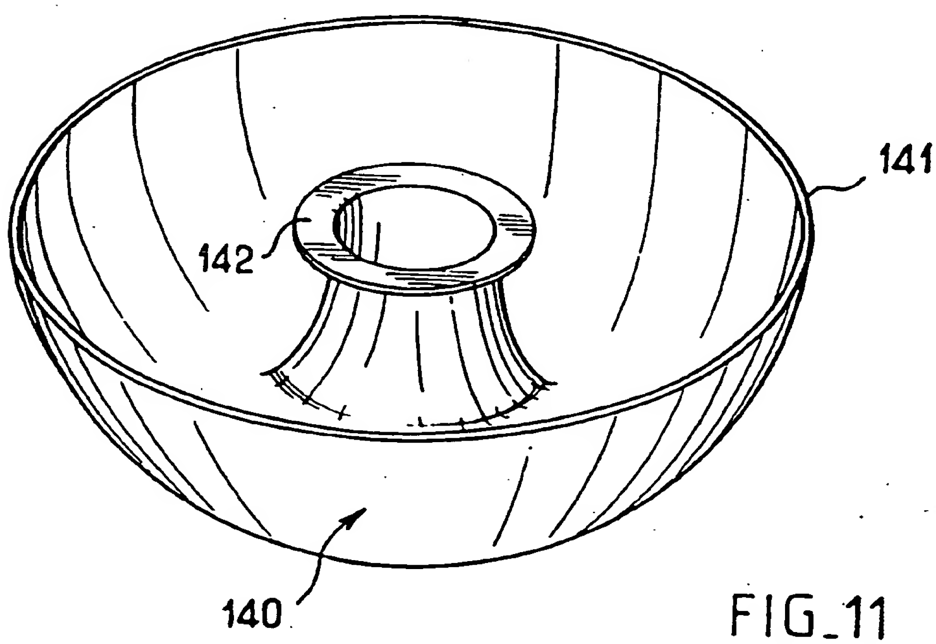


FIG_11

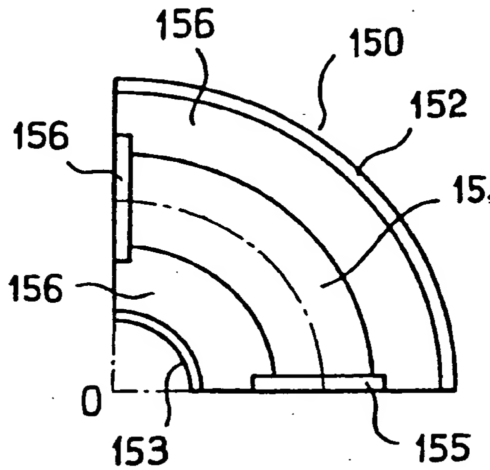


FIG_12

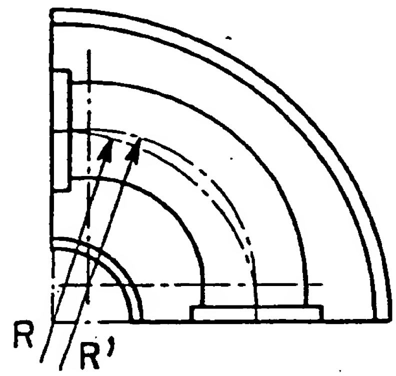


FIG_13

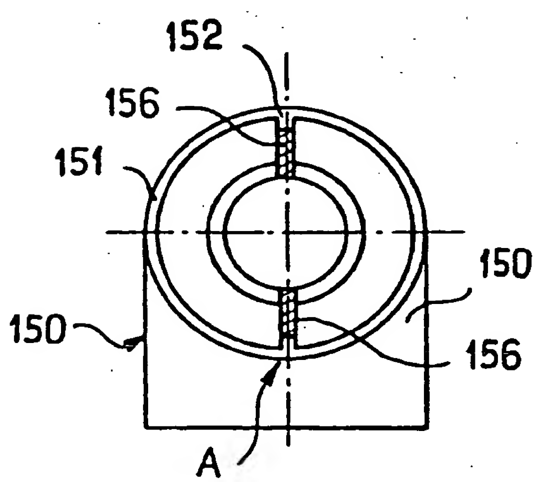


FIG_14

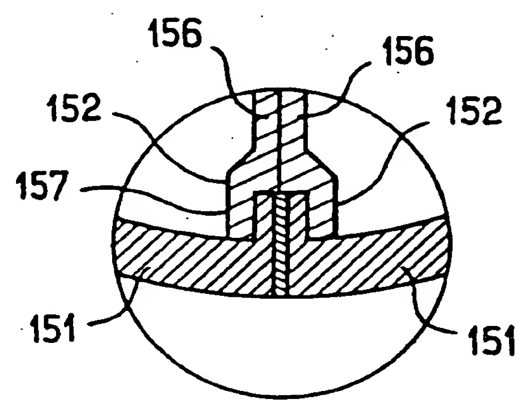


FIG_14A

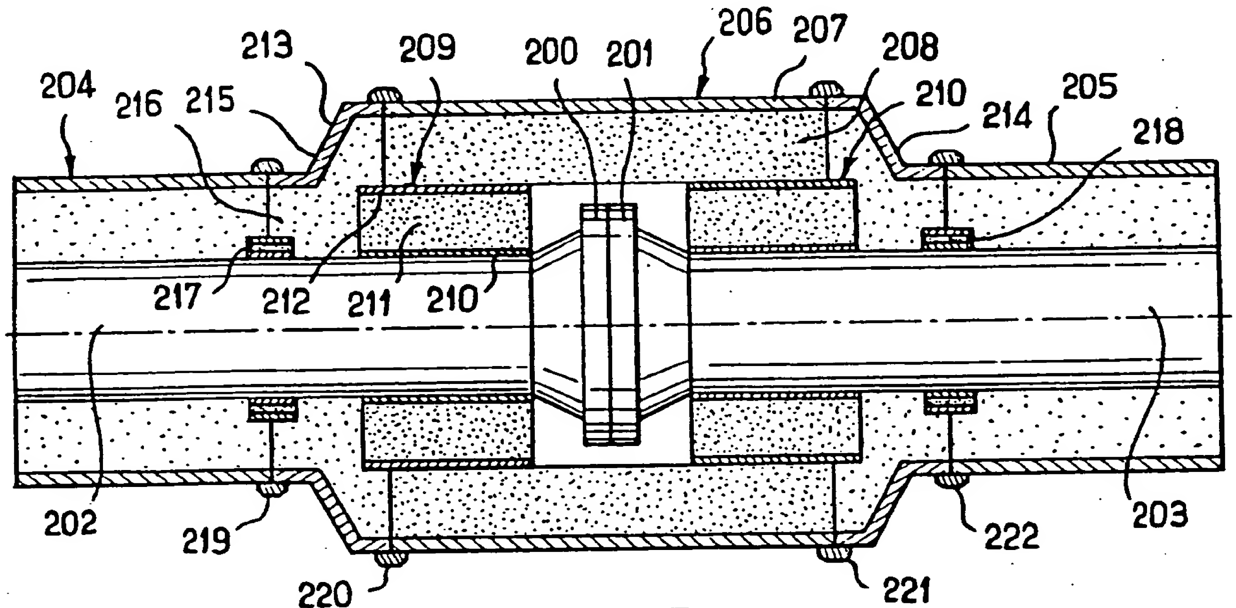


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FIG_15

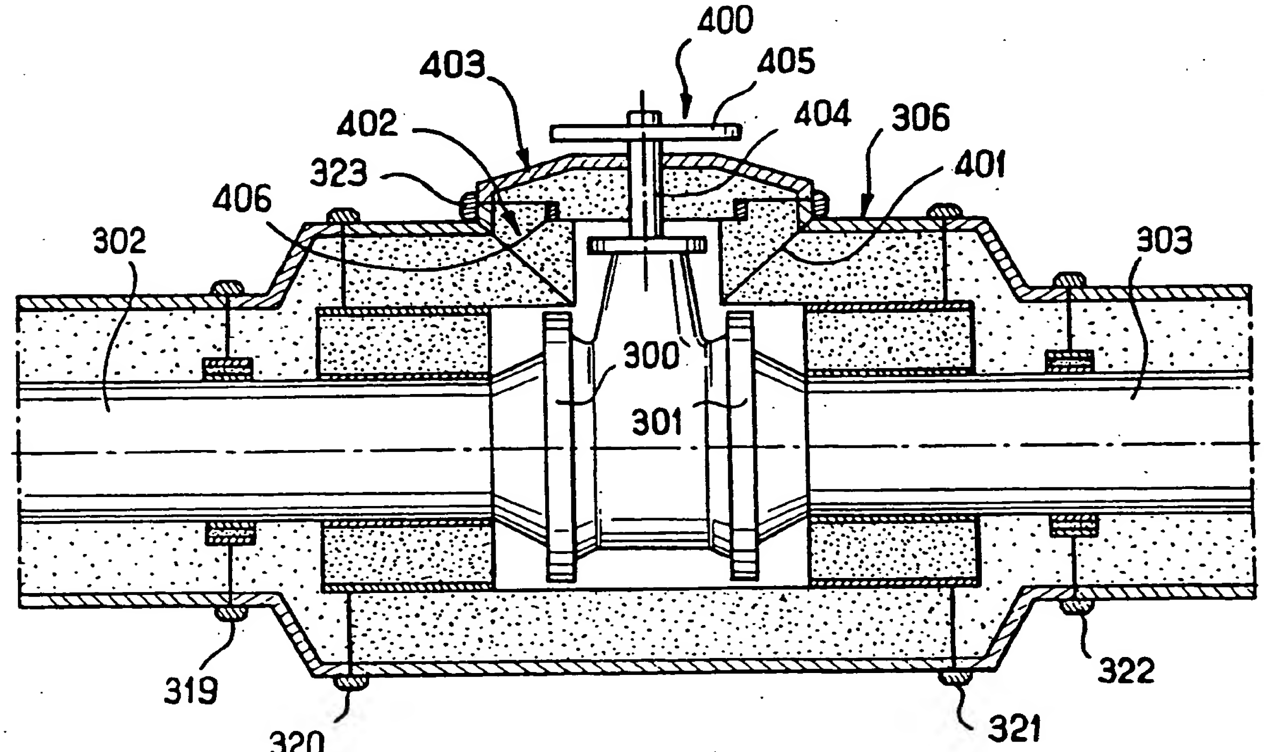

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FIG_16

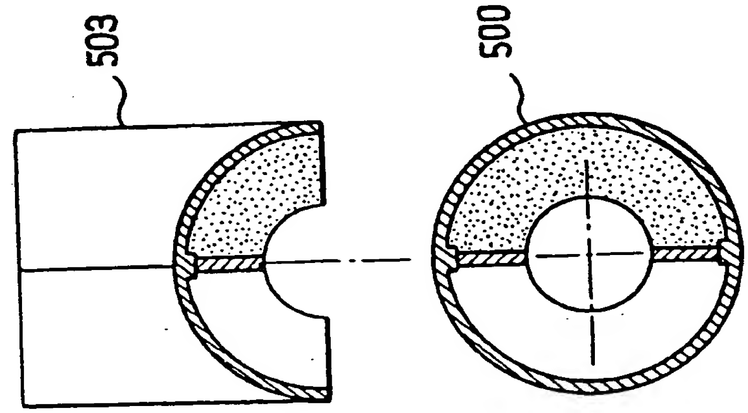

FIG_18

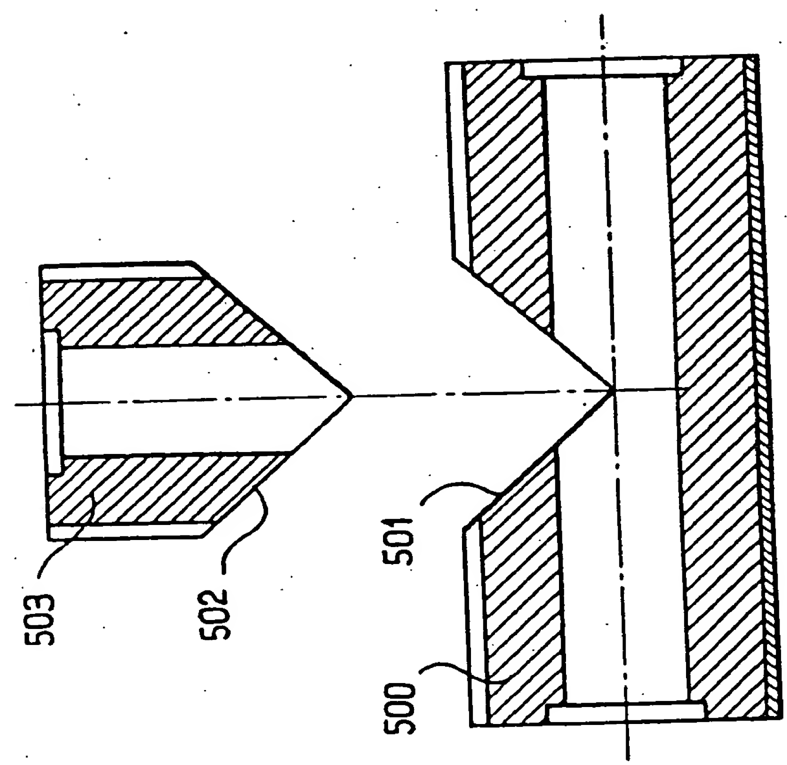

FIG_17

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"Pipe-insulating element and insulating assembly formed thereby"

The present invention relates to a pipe-insulating element and also to an assembly formed by such insulating elements, and to a process for the manufacture of such elements.

Such insulating elements are known especially from document 93 05 308 which discusses the problem of the in situ insulation of pipes, and attempts to remedy the problem by means of factory-manufactured insulating elements.

This solution, however, has the disadvantage of not being sufficiently impermeable in spite of the seal placed in a longitudinal groove formed in the joint surface.

The present invention proposes to simplify to a considerable extent the techniques of insulation by creating insulating elements which are manufactured in the factory and the mounting of which on the pipes to be insulated is especially simple, rapid and very impermeable to fluids, especially trickling fluids, or to vapour.

To that end, the invention is characterised by the means of the characterising portion of the first claim.

The insulating elements are simply joined *in situ* around the pipes, which enables the fitting time to be substantially reduced and which also gives the advantage of an insulation which is very impermeable to vapour, with excellent seals and factory-quality foam. This quality of insulation permits efficient insulation of the pipes traversed by fluids at temperatures of between -200 and +100°C.

The various features of a pipe system can be taken into account by *in situ* adaptation, for example for connection pieces and other accessories with which a pipe system is equipped.

Owing to the close contact between the external covering and the rigid foam, a substantial mechanical strength is obtained which, where appropriate, even enables the thickness of the covering to be reduced.

In all cases, the insulating element is bounded by two joint surfaces against which the other element(s) are joined, and the folded edges

of the sheet forming the wall are in each case arranged in the joint plane provided with a flexible foam reducing or preventing the circulation of air and thus the risk of pipe corrosion. This foam also absorbs the dimensional tolerances.

The invention relates also to a process for the manufacture of an insulating element.

A process according to the invention consists in placing the gel-coat in the mould, then the shells before the polyester polymerises. This process permits close contact between the polyester and the shell. A strip prevents the adhesive bonding of the shell over a given area and therefore facilitates opening.

The present invention will be described hereinafter in a more detailed manner using the appended drawings, in which:

- Figure 1 is a diagrammatic perspective view of a first embodiment of an insulating element according to the invention;

- Figure 2 is a perspective view of a second embodiment of an insulating element according to the invention;

- Figure 3 is a sectional view of the assembly of insulating elements according to Figure 1;

- Figure 4 is a sectional view of the fitting of a variant of the enveloping insulating element;

- Figures 5A, 5B and 5C show three stages of the manufacture and shaping of a sheet forming the external wall of an insulating element according to Figure 1;

- Figure 6 is a diagrammatic perspective view of a template for the manufacture of an insulating element according to Figure 1;

- Figure 7 is a sectional view of an assembly of several templates and of a partition used to manufacture an insulating element according to Figure 4;

- Figure 8 is a longitudinal section through the junction of two insulating assemblies placed end to end;

- Figure 9 is a section along IX-IX of Figure 8;

- Figure 10 is a semi-section showing the placing end-to-end of two insulating elements before they are joined, without using an assembly key;

- Figure 11 is a perspective view of an external wall which is used for the simultaneous

manufacture of four insulating elements for angled portions of insulating installations;

- Figure 12 is a plan view of an angled insulating element;

- Figure 13 shows a variant of the angled insulating element;

- Figure 14 is a side view of the assembly of the joining of two insulating elements according to Figure 12 or 13;

- Figure 14A shows detail A of Figure 14;

- Figure 15 is a sectional view of a pipe in the area of a flange junction showing the insulation assembly taking into account the increase in diameter of the flanges;

- Figure 16 is a sectional view of an insulating assembly in the area of a valve; and

- Figures 17 and 18 show diagrammatically the assembly of the insulating elements in the area of a T-shaped junction.

In general, the invention relates to a pipe-insulating assembly formed by insulating elements fitted on a pipe through which a hot or cold fluid flows.

According to the example of Figure 1, this insulating element 1, which corresponds, for example, to half of the periphery of the complete

insulating assembly, is in the form of a shell of which the external covering 2 is formed by a sheet, for example sheet-metal or a sheet of plastics material. The covering surrounds a portion comprising rigid foam 3. The edges 4, 5 of the covering 2 are folded at right-angles; they are used for joining two elements 1 to one another or for closing an insulating element on itself, as will be explained hereinafter; assembly is effected in the longitudinal direction, that is to say, the direction of the pipe.

Its face corresponding to the joint plane formed by the flat face of the element, which, in the position shown, is the face turned upwards, is provided with a layer of flexible foam 4. A portion 4′ of the foam may or may not pass under the flanges 5 of the external covering 2, as the case may be.

A longitudinal depression 6 is formed in the joint plane and its shape is matched to that of the pipe for which the insulating element 1 is intended; the shape is, for example, a semi-cylinder with a circular cross-section.

The layer of flexible foam 4 may also continue around the longitudinal depression 6 with a portion 4'' of corresponding shape.

The layer of foam 4 is preferably placed in the mould and the mass of material forming the rigid layer 3 is then introduced into the mould and adheres not only to the internal surface of the covering 2 but also to the internal surface of the layer of flexible foam 4.

The other surface of the layer of flexible foam 4 preferably comprises an adhesive covering protected by a sheet which can be peeled off, in order to permit the joining of two insulating elements 1 to one another.

Depending on the case concerned, for this assembly, only one of the insulating elements comprises an adhesive covering and the other does not or both insulating elements comprise an adhesive layer.

The surface of the joint plane also comprises male/female assembly parts 7, 8, which are raised and recessed relative to the joint plane and have identical cross-sections, in homologous positions relative to the axis of the

depression 6 of the pipe. These assembly parts 7, 8 extend along the entire length of the insulating element 1.

According to the invention, these elements 1 are assembled around the pipe to be insulated so that the male/female assembly parts 7, 8 interlock and form baffles in the joint plane. These baffles improve sealing and insulation and ensure a certain locking. At the moment of assembly, the folded edges 5 of the external wall 2 are supported against one another by assembly devices (not shown), such as, for example, pliers, or by means of adhesive bonding.

In this example, the edges 5 of the sheet forming the external wall are folded down towards the inside. In some cases, it may be advantageous if the assembly edges are folded down towards the outside.

Customarily, the insulating elements correspond to half of a complete insulation structure around a pipe and the joining of two elements is effected in the diametral plane passing through the pipe. Other embodiments are possible, such as, for example, those of a quarter

of a circle or a third of a circle or also a complete circle.

More especially, the materials forming the element are selected so as to meet specific criteria.

The external covering must be:

- a heavy-duty obstacle to the diffusion of water vapour (which phenomenon would destroy the capacity of the insulator);

- aesthetic and age-resistant in the various industrial environments (the material depending on the environment);

- resistant to mechanical attack in combination with the rigid foam.

The insulating rigid foam must:

- have a very low coefficient of conduction for a cost per unit of volume that is as low as possible;

- be sufficiently rigid to be able to withstand the mechanical stresses transmitted by the external covering or by the weight of the pipe system;

- must be readily usable in the workshop.

The flexible foam used mainly in the area of the joint planes and at any place where dimensional imperfections exist must:

- be sufficiently flexible to correct dimensional defects in the tube or the joint planes;
- have a coefficient of resistance to the diffusion of water vapour which is sufficiently great to constitute an efficient barrier to that phenomenon;
- exhibit a coefficient of conduction as close as possible to that of the rigid foam.

The embodiment of an insulating element 101 according to Figure 2 basically differs from the first embodiment in that the joint face does not comprise a male/female assembly part 7, 8 but a flat surface. The various elements of this embodiment which is identical with the first embodiment according to Figure 1 have the same reference numerals and their detailed description will not be repeated.

Figure 3 shows the joining and the assembly of two elements 1 on a pipe 9, the interlocking of the male/female assembly parts and also the coming into contact of the folded edges against one another. Only the members for

connecting the coverings 2 have not been shown. Because the elements 1 are identical they can be nested. Owing to this identical form, the drawings use the same reference numerals to designate the same portions of the elements.

This sectional view shows two variants of the insulating element 1 (101) in the same Figure; on the right insulating elements 1 according to the embodiment of Figure 1 and on the left insulating elements according to the embodiment of Figure 2.

It is also possible to combine in the same insulating element the means of the two embodiments, as also shown in Figure 3.

Figure 4 shows another example of an insulating element 20 according to the invention. This element is a single element. It is composed of two portions which are joined by a connection forming a hinge and the manufacture of which will be described hereinafter. The element 102 is composed of an external covering 21 formed by a single external wall having two folded edges 22, 23 and carrying integrally two circular semi-cylinders 24, 25 comprising rigid insulating

expanded material secured to the wall and preserving the curved shape thereof.

In the middle 26 of the wall 21 of this element, the portions 24, 25 of rigid insulating foam, corresponding substantially to the halves, are separated from the internal surface of the wall in order to facilitate the opening of this area 26 forming the articulation. To that end, before introducing the foam, a strip 27 of which the upper face is not adhesive with respect to the foam of the portions 24, 25 is applied to the internal face of the wall, along the area 26 forming the hinge.

The articulation 26 formed by the external wall 21 permits the partial opening of the insulating element 102 to a sufficient extent to introduce the pipe 9 to be insulated and to cause it to pass into its depression 28, 29 formed in halves by cavities 28, 29 in each of the portions 24, 25.

For the same reasons as those given above, the opposing faces of the two portions 24, 25 of the element 102 may comprise male/female assembly parts 30, 31 forming a sealing and locking baffle.

This baffle is provided by way of example only on one half of the two portions of rigid foam 24, 25, the other portion having a smooth surface in the area of a joint plane.

As above, the joint plane of the two rigid portions 24, 25 is occupied by a layer of flexible foam 32, 33 and at least one of the surfaces of the two layers of foam 32, 33 is adhesive and comprises a pealable film which is removed in order to join the two layers 32, 33 face to face.

The insulating element 102 is closed in the same manner as in the other cases above by assembling the folded portions 22, 23 edge to edge and locking them by the adhesion of the layers 32, 33 and any connecting members (not shown) for the covering 21 in the area of its edges 22, 23.

In the various examples of the insulating elements 1, 101, 102 described hereinbefore, the joint surfaces are provided with male/female assembly parts 7, 8, 30, 31 having a triangular cross-section; other forms are possible and the number of these parts may differ from that of the previous examples.

At the moment of mounting, the silicone paper protecting the layer of adhesive is removed and pressure is applied to the two insulating elements to be assembled so that the adhesion is effective over the entire surface. This pressure is applied by means of tension devices judiciously arranged on the external surface.

This pressure is absolutely necessary for the compression of the foam over its entire surface in order to bring the insulating elements to be assembled into contact with one another in spite of the geometrical imperfections of the joint plane. When the tension devices are removed, a close connection exists and external forces necessary for sealing are zero. Some areas of the flexible foam are under compression and others are under expansion, depending on the irregularities of the surface, and the forces are therefore compensated for.

This procedure meets technical sealing requirements but does not enable the insulation structure to be dismantled.

In cases where dismantling must be possible, the joint plane is not adhesively bonded, as has just been described, but a device

is provided which maintains the flexible foam under compression for as long as it is in use.

This device may comprise straps tightened by means of judiciously arranged tension devices, or securing clips positioned in the area of the fold of the external covering.

Finally, in order to perfect the impermeability of this longitudinal joint, a seal of the butyl rubber type (or the like) is placed on the folded portion of the external covering. This seal is put in position in the factory with a silicone paper which is removed at the moment of assembly.

Figures 5A-6 show an example of the process for the manufacture of insulating elements such as that of Figure 1.

According to Figure 5A, starting from a sheet 40 of metal plate or plastics material, the edges 41 of which are or will be folded at right-angles, optionally with complete folding to produce a double thickness 42 according to Figure 5B, the resilience of the sheet is used to give it the shape of a semi-cylinder (Figure 5C) and this shape is locked in a template 43 (Figure 6). The

number of templates will depend on the length of the insulating element to be produced.

The mould thus formed by the curved sheet 40 is placed in a template 43 completed by a lid 44 equipped with a tubular central portion 45 forming the moulding core which constitutes the depression intended for the pipe to be insulated.

According to this example, the lid 44 has the shapes 46, 47 of the assembly parts. It is formed by a plate reinforced with cross-pieces 48, for example at right-angles to the templates 43.

Before closing the mould thus produced, with the lid 44, the lid is provided with a sheet of flexible foam 49 of which the surface positioned on the lid side is covered with a layer of adhesive protected by a pealable film (not shown). The whole is held in place against the lid 44, for example by reduced pressure.

When the mould is thus formed, the insulating foam 50 is injected and becomes attached to the wall 40 and locks the curved shape thereof. However, this foam adheres to the flexible foam 49.

It will be appreciated that this mould can also be used with a lid 44 that does not comprise the shapes 46, 47 but which is simply smooth.

Equally, while in this example the layer of foam 49 is formed by two longitudinal strips which meet in the area of the central portion 45, it is also possible to provide a single sheet of foam which also envelops this central portion 45 in such a manner that it later surrounds the pipe to be insulated.

The whole is assembled by assembly means which can be removed in order to facilitate opening and the removal of the insulating element from the mould, such as the means shown in Figure 11.

The length of the insulating element may be standard or may be customised. It is sufficient to use a sheet 44 of suitable length and to adapt the templates 43 and the lids 44. The ends of the insulating element are produced in such a manner as to facilitate longitudinal joining, providing characteristics of insulation and mechanical strength.

The templates permit the manufacture of insulating elements having a specific diameter as a function of physical parameters, depending on the insulating characteristics to be obtained.

For the same template, it is possible to select different lids according to the cross-section or the shape of the pipe to be insulated and the shape of the assembly parts to be moulded.

Figure 7 shows, in section, the production of an insulating element such as that in Figure 4. To that end, use is made of a lower template 60 which has a semi-circular cavity 61 for receiving the portion of the sheet 62 which forms half of the wall of the insulating element. After the positioning of the sheet 62, this lower template 60 is supplemented by two upper templates 63, 64, each of which corresponds substantially to a quarter of a circle. Inside the sheet 62 positioned in the lower template 60 is placed a separating partition 65 which is arranged in accordance with a preferably vertical diameter, for the vent holes of the upper portion. This separating partition 65 is formed by a tube 66 which has a cross-section corresponding to that of the pipe which is to receive the insulating element. This tube carries two wings 67, 68

similar to those of the lid of Figure 7. Depending on the particular case, the tube is in a single piece and the wings are welded on; it is also possible to have a tube divided into two halves secured to the wings which are then in a single piece. This partition projects with the top 69 beyond the closed tube formed by the sheet having folded edges 70, 71.

After the injection of the insulating foam forming the portions 72, 73, the insulating element thus produced is removed by taking away the upper templates 63, 64 and then opening the element slightly in order to remove the partition 65 therefrom.

Since the wings 67, 68 have a certain thickness, and in the case of a sheet which is complete over the entire periphery of the insulation structure, a gap exists between the insulating portions after moulding; this gap which is of zero thickness in the area of the folded edges 70, 71 increases to the thickness of the sheet-metal of the wings, at the other end, which is diametrically opposite to that of the edges 70, 71.

Such a gap is detrimental to the efficiency of the insulation structure and it is therefore provided according to the invention not simply to inject into the mould but to coat the surface of the wings and of the half-pipe with a sheet of flexible foam beforehand and then to inject the insulating material proper 72, 73 in order to obtain insulating elements of which the assembly surface is formed by the sheets of foam. This enables certain irregularities to be compensated for, especially on the surface of the pipe (excessive thicknesses owing to weld seams, etc.).

During injection, the insulating material adheres to or attaches itself to the sheet of foam, the latter not adhering to the walls of the mould.

It should be noted that the sheet of foam is crushed at the moment of injection and expands again after removal from the mould and can fill the gap resiliently during the positioning of the insulating element around the pipe.

The sheet of foam may be an "Armaflex" sheet or the like (registered trade mark).

According to one process, a gel-coat is placed in the mould followed by the polyester and finally the flexible foam before the polymerisation of the polyester.

The covering thus produced then receives the shells of rigid foam comprising flexible foam at the desired areas.

The flexible foam arranged between the shells and the covering permits close contact between the shells and the external covering.

Another process consists in placing the gel-coat in the mould, then the shells before the polyester polymerises. This process permits close contact between the polyester and the shell. A strip prevents adhesion of the shell over a given area and therefore facilitates opening.

Figures 8 and 9 show a longitudinal section and a transverse section through the end-to-end assembly of two insulating elements 103 according to the embodiment of Figure 1 or 2.

This joint must ensure excellent sealing in order to prevent the passage of vapour and thus

to avoid a reduction in the insulating characteristics.

Each element 103 is composed of an external covering 80 and a core of rigid foam 81 and also layers of flexible foam 82 (Figure 9).

For assembly in the area of the joint, a key-shaped member 104 is provided and is placed in a cavity or groove 83 formed in the front face 84 of each of the insulating elements 103 to be joined. This depression 83 is in the form of a peripheral groove which opens out near the tube 105 to be insulated.

This assembly element 104 is composed of a two-part core of rigid foam 91 which is surrounded by a covering of flexible foam 92. A layer of flexible foam 93 is secured, for example, in the cavity of the rigid foam 91 and comes into contact with the tube 105. The external surface of the covering 92 and the internal surface of the flexible layer 93 are covered with an adhesive layer in order, on the one hand, to be attached to the elements 103, in the peripheral groove and, on the other hand, to be supported on the tube 105. A barrier is thus created which prevents the passage and circulation of vapour.

The opposing faces are not adhesively bonded to one another. In general, it is sufficient to encircle the joint with a joint cover 94.

Figure 8 shows in more detail the structure of the key and an insulating assembly 103, 104, illustrating the vapour barrier thus produced. This barrier prevents the circulation of vapour between the insulating assembly and the tube 105, or at least restricts this circulation to the length of an insulating assembly between two structures assembled together. In the case of an insulating assembly which is also provided with a flexible covering on its face turned towards the pipe to be insulated, the key 104 constitutes a supplementary barrier.

Since the key has a diametral joint plane, it is preferable for safety reasons to offset this joint plane at an angle relative to the joint plane of the insulating elements which this key joins, for example at an angle of 90^{o}.

In order to facilitate manufacture and reduce stocks, the keys have dimensions (diameter, length) suitable for a range of insulating elements.

In addition, although the grooves at the end of the insulating element are generally produced in the factory, for special cases of insulating elements having dimensions adapted <u>in situ</u>, the grooves may also be produced <u>in situ</u>.

Figure 8 shows the case of an insulating assembly formed by a single element folded on itself, like that of Figure 4.

Figure 10 is a semi-section showing a variant of the ends 122, 123 to be joined of two insulating elements 120, 121 mounted on a pipe 124.

The end 123 of one or both opposing ends is a layer of foam provided with an adhesive covering for a vapour-proof assembly.

Figure 11 shows one possible embodiment of the insulating elements for an angled portion.

For that purpose, a member 140 is produced, by spinning in the form of a torus cut along its diametral plane (in the shape of a cake mould); this member forms the external wall of several insulating elements, especially four insulating elements each corresponding to an

angled portion of 90° or eight elements for an angled portion of 45° (forming a total of 360°).

The internal edge 141 and the external edge 142 of the sheet 140 are folded.

This member 140 receives a lid (not shown), and then the insulating foam is injected into the mould. The foam becomes attached to the member 140 but not to the lid. For removal from the mould, the lid and its toroidal core are removed. An assembly is obtained which can be cut to give eight or four insulating elements for 45° or 90° angled portions, or more insulating elements for smaller angles of 30°, 22.5° etc.

It is necessary only to cut or saw this member along the radii. In the commonest case, cutting is effected along arcs having angles of 90° but other usual angles are possible, for example 45° or 135°, according to requirements.

The angled insulating elements are assembled in the same manner as the straight elements by edge-to-edge mounting using assembly devices, such as pliers.

Figure 12 shows an example of an insulating element 150 for a 90° angled portion which is equipped with an external covering 151 terminated by two flanges 152, 153, at the inside and the outside, in the plane of symmetry of the assembly. The depression 154 on the angled portion of the pipe is produced by moulding. An assembly cavity 155, 156 is provided at each end to receive a key like that of Figures 8 and 9.

Because the external covering 151 is produced by shaping, for example spinning in the case of sheet-metal, the shapes are restricted by the tools and stocks available. Thus, the external coverings (cf. Figure 11) are produced only for a few diameters and not for an almost continuous series. The diameters are suitable for angled insulating elements, the radii of curvature of which are close to the radius of curvature of the covering thus produced.

By way of example, the centre of curvature O of the pipe received in the depression 154 of the element 150 coincides with that of the element 150 but this corresponds only to a single possible radius of curvature R for the pipe.

In order to use the same covering 151 for angled portions having radii of curvature (R′) which differ from but are nevertheless close to the radius R (Figure 13), the depression 154′ is produced by a core of which the centre of curvature radius is not at 0 but is offset towards the outside on the bisector of the sector corresponding to the angled portion.

Although the production of the depression by a moulding core is advantageous, it is also possible to proceed by machining, for example with a template.

The two elements 150 are joined as indicated in Figure 14 which shows the layers of foam 156. Detail A of Figure 14 given in Figure 14A shows a strip of mastic 157 between the flanges 152.

Figures 15 and 16 show two applications of the building up of the insulating assembly using keys.

According to Figure 15, the insulating assembly surrounds the assembly flanges 200, 201 of two pipes 202, 203.

The pipes 202, 203 are provided with insulating elements 204, 205 such as those described above in one or two parts, the description of which will not be repeated.

The increase in diameter of the flanges is insulated by an insulating element 206 having a structure similar to that of the elements 204, 205, that is to say, comprising an external covering 207 and a portion 208 of rigid foam. Between this element 206 (in one or more parts) and the pipe 202, 203 on each side of the flanges 200, 201, there is a key 209, 210 having an outside diameter adapted to the inside diameter of the element 206.

These keys 209, 210 have the same structure as the key of Figure 8, that is to say, an internal portion 211 comprising rigid foam and equipped externally and internally with a covering 212, 213 of flexible foam.

The connection between the elements 204, 206 and 205, 206 is effected by two transition elements 213, 214, each of which has an external covering 215 and an internal portion comprising rigid foam 216.

Each transition element 213, 214 is connected, on the one hand, to the element 206 by the two keys 209, 210 and, on the other hand, to the two elements 204, 205 by keys 217, 218.

Finally, the joints are equipped with joint covers 219, 220, 221, 222.

The insulating assembly for a valve according to Figure 16 is similar to that described in Figure 15 and only the means that are different will be described here.

The various elements and means which are not described again, but which are identical or analogous to the previous elements and means, have the same reference numerals increased by 100.

Diagrammatically, the insulating assembly for the valve is derived from the previous assembly simply by lengthening the element 306 which is provided at its portion associated with the head 400 with a conical opening 401 for receiving an insulating element 402 (in one or two parts), having the same structure as the other insulating elements, completed by a lid 403 which also has the same structure as the insulating elements.

The lid 403 is connected to the element 402 by a key 406.

The various joints are provided with joint covers 319, 320, 321, 322, 323.

Figures 17, 18 show the assembly of the insulating elements in the area of a T in the pipe system. This assembly is similar to that described for the valve (elements 306, 402).

The insulating element 500 is provided with a mitre cut 501 (45°) for receiving the end 502 (having the same conicity: 45°) of the element 503.

The elements 500, 503 in one or more parts have the same structure as the insulating elements already described. This description will not be repeated.

WHAT WE CLAIM IS:

1. Pipe-insulating assembly formed by insulating elements for surrounding a pipe with joint surfaces optionally comprising interengaging male/female assembly parts (7, 8), which are homologous, extending along the entire length of an insulating element (1), wherein

- each insulating element (1) comprises an external covering (2), especially a sheet of metal or plastics material, which is curved in the shape of a channel, is formed by a sheet terminating in flanged edges (4, 5) and corresponds at least to a portion of the periphery of the insulation structure to be produced, which channel receives an insulating part comprising rigid foam (3) leaving a depression (6) having a shape and dimensions corresponding to those of the pipe to be insulated,

characterised in that the insulating part (3) is provided on its joint surfaces with a layer of flexible foam (4), and the closing of an insulating element (1) on itself or the joining of insulating elements to one another being effected face to face by the layers of flexible foam (4).

2. Assembly according to Claim 1, characterised in that the ends of the insulating elements (103) are provided with grooves (83) for receiving a tubular impermeable assembly element (104) which covers the pipe (105) to be insulated and is accommodated in the two opposing grooves (83) of two assemblies of insulating elements (103) to be joined end to end.

3. Assembly according to Claim 1, characterised in that the external surfaces of the layers of flexible foam (4, 4', 4'') are provided with an adhesive covering protected by a pealable film.

4. Assembly according to Claim 1, characterised in that the insulating element is composed of a curved sheet (21) corresponding substantially to the periphery of the insulating element to be produced and carrying two portions of rigid foam (24, 25), each of which corresponds to half of the whole insulation structure and is equipped on its visible face with a flexible foam (30, 33) bounded on one side by the respective flanged edge (22, 23) of the wall (21), the centre of this wall (21) forming a longitudinal articulation (26) enabling the two halves to be

opened at least partially in order to surround the pipe.

5. Assembly according to Claim 1, characterised in that the external wall (140) is shaped in the form of a toroidal channel receiving an insulating part with a depression which is likewise toroidal.

6. Assembly according to Claim 1, characterised in that the external covering comprises, in the area of the rigid foam part, an intermediate layer of flexible foam.

7. Process for the manufacture of a pipe-insulating element according to Claim 4, characterised in that a sheet (62) having a width corresponding to the periphery of the pipe insulation structure to be produced is taken and folded, partially in a template (60, 61) corresponding to a semi-circle, and then a diametral partition (65) is placed inside the channel thus produced with the sheet, the side edges of the sheet are closed to form a complete casing and the curvature thus produced is locked by means of complementary templates (63, 64), the bent edges (70, 71) of the sheet forming the wall meeting against the partition (65),

the partition (65) carrying a tube (66) in a central position in order to form the moulding core constituting the depression of the pipe to be insulated, then the foam is injected into the mould thus formed, after having covered the partition and, where appropriate, the pipe (66) with a sheet of foam which becomes integral with the injected foam and after having placed, in the longitudinal area (26) of the sheet (21), forming the hinge enabling the two halves of the insulating element to be opened, an adhesive strip (27) on the internal surface of the sheet, the external surface of that strip not being adhesive with respect to the foam of the insulating element.

8. Process for the manufacture of an insulating element for enveloping an angled portion, according to Claim 5, characterised in that:

- a member (140) in the shape of a torus cut along its diametral plane is produced;
- the torus is placed in a cooling jig;
- the flexible foam is placed in the torus;
- the foam is injected between the torus and the flexible foam;
- a lid (152) is placed on the cooling jig during the expansion phase of the foam;

- demoulding is effected and then the mould of the tube is machined into the torus, the torus is subsequently cut, the lid being provided with a depression corresponding to the angled portion of the pipe, or the depression is produced by a machining operation controlled, for example, with a template.

9. Process for the manufacture of an insulating element according to Claim 6, characterised in that:
- the mould is coated with a gel-coat;
- the polyester is then introduced;
- and the polyester is covered with flexible foam before the polymerisation of the polyester;
- shells of hard foam are produced separately and are placed in the covering after polymerisation.

10. An insulating element for a pipe comprising a rigid insulating material having a channel to accommodate the pipe and adapted to cooperate with one or more other such insulating elements to form an insulating assembly completely surrounding the pipe, wherein the insulating element has a surface which in use abuts with a corresponding surface of another such insulating element, which surface is provided with a layer of resilient material.

11. An insulating element according to claim 10, wherein the rigid insulating material is provided with an outer skin which is flanged to extend partially over said surface.

12. A pipe-insulating assembly comprising at least two insulating elements, as defined in claim 10 or 11 assembled together so that the layers of resilient material of the two elements are in contact with one another.